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INDIVIDUAL STUDY PROGRAM

USAF RANGE ACQUISITIONS FOR THE
SPACE SHUTTLE/SATELLITE CONTROL SATELLITE ERA

Study Project Report
PMC 76-2

Robert E. Lauck
MAJ USAF

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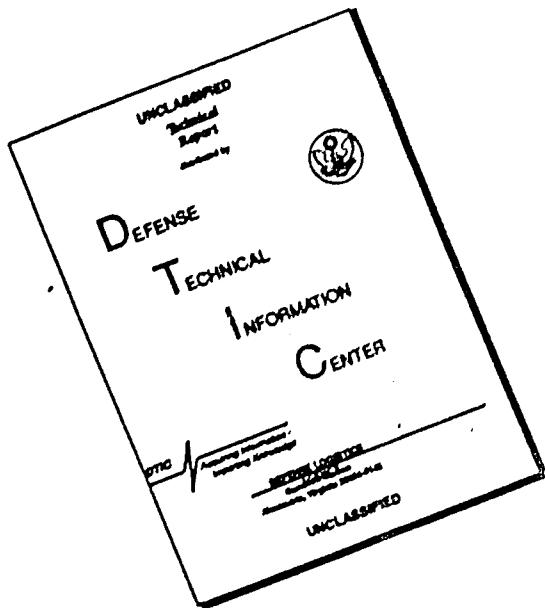
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DEFENSE SYSTEMS MANAGEMENT COLLEGE

STUDY TITLE:

MAJOR RANGE ACQUISITIONS FOR THE SPACE SHUTTLE/SATELLITE CONTROL SATELLITE ERA

STUDY PROJECT GOALS:

(1) Review the planning, programming and budgeting system for the USAF National Ranges (ETR, WTR and SCF). (2) Identify future USAF Range requirements for the Space Shuttle/Satellite Control Satellite (SCS) era. (3) Assess the effectiveness of current Range PPBS directives and regulations in providing for the major acquisitions needed in the Shuttle/SCS era. (4) Suggest improvements.

STUDY REPORT ABSTRACT:

The 1980's will see a new era in military space activities. The Space Shuttle and Satellite Control Satellite are two systems which will expedite a transition from a research and development orientation to operational exploitation of this fourth medium. The USAF National Ranges (Eastern Test Range, Western Test Range and Satellite Control Facility) will experience extensive changes in their missions and configuration with the advent of these systems.

This study examines the directives and regulations governing the planning, programming and budgeting system (PPBS) for these Ranges. A review of potential changes to the Ranges to fully exploit the Shuttle and SCS capabilities is then accomplished. Capabilities which improve the effectiveness of space operations are analyzed, as well as, cost-saving and security improvements. It is concluded that major changes to Range configurations can be expected as a result of the employment of the Shuttle and SCS systems. An assessment of the effectiveness of the PPBS guidance to stimulate the necessary actions to accomplish these changes follows, with the conclusion that the Test and Evaluation (T&E) orientation of these directives and regulations does not provide the best environment for proper Range planning as we approach this new era in space operations. Recommendations include; revision of documentation to reflect the expanding operations roles of the Ranges; organizational changes at OSD and HQS AFSC levels; and establishment of an SCS program office within the Satellite Control Facility.

SUBJECT DESCRIPTORS:

Planning-Programming-Budgeting-System, USAF National Ranges, Space Shuttle, Satellite Control Satellite, Space Operations, Future DOD Activities in Space.

NAME, RANK, SERVICE	CLASS	DATE
Robert E. Lauck, Major USAF	PMC 76-2	November 1976

USAF RANGE ACQUISITIONS FOR THE
SPACE SHUTTLE/SATELLITE CONTROL SATELLITE ERA

Study Project Report
Individual Study Program

Defense Systems Management College

Program Management Course

Class 76-2

by

Robert E. Lauck

November 1976

Study Project Advisor
Mr. William H. Cullin

This study project report represents the views, conclusions and recommendations of the author and does not necessarily reflect the official opinion of the Defense Systems Management College or the Department of Defense.

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EXECUTIVE SUMMARY

The 1980's will see a new era in the military utilization of space.

DOD activities in the medium of space are expanding and transitioning from a research and development orientation to operational applications to meet military requirements. The Space Shuttle System and a Satellite Control Satellite (SCS) are two systems which will open a new era in space activities where operational applications can be exploited. As the ground segment of space systems, the USAF National Ranges (Eastern Test Range, Western Test Range and Satellite Control Facility) will need to undergo extensive modification if the capabilities and economies offered by these systems are to be fully realized. This Study Project analyzes the documentation governing the Planning, Programming and Budgeting System (PPBS) for the USAF National Ranges to determine if the proper environment exists to effect these major changes to the Ranges in order to take full advantage of the potential offered by the Shuttle and SCS Systems.

Current directives and regulations governing PPBS activities for the USAF National Ranges are reviewed. A discussion of the modifications at each of these Ranges that will be possible in the Shuttle/SCS era follows. An assessment of the effectiveness of current PPBS actions to properly plan for these changes is then made. It is concluded that there are disadvantages to continuing current practices in managing our space activities. The transition from a research and development orientation to an operational orientation must take place to ultimately integrate space functions into the operational Air Force. Responsibility for the operational ground segment of these space forces should be transferred from the Test

and Evaluation offices to the Systems offices. A Satellite Control Satellite system should be vigorously pursued to fully exploit the military potential of space along with the Space Shuttle and provide a more cost-effective and secure means of support to our space systems.

ACKNOWLEDGEMENTS

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SECTION I

INTRODUCTION

PURPOSE

It has been nearly 20 years since Sputnik I was launched by the USSR. Our space activities began with Explorer I shortly thereafter. Great strides have been taken since that first Explorer launch but DOD activities in this fourth medium have generally been viewed as exploratory or research and development oriented. This is not to say that space systems have not been utilized by DOD operational units. But, by and large this has been accomplished in and through the research and development arenas. As we move into the second 20 years it appears appropriate to ask, "Have we provided for the transition from R & D to user orientation in the evolution of space systems?" This idea was included in a study by the Space Applications Board of the National Research Council in 1974:

"There is an important transitional stage between research and development and the implementation of an operational applications system. In the transitional stage, the technological capabilities of the system have been demonstrated, but the user community is not yet aggregated or has not yet had sufficient opportunity to try the system and decide if it should replace or supplement older methods. If the transitional stage is not provided for, systems that could provide important benefits may not come into use." (1:34)*

It is this thought which underlies the purpose of this Individual Study Project. The author believes that DOD activities in the medium

*This notation will be used throughout the report for sources of quotations and major references. The first number is the source listed in the bibliography. The second number is the page in the references.

of space are expanding and that we are at this transitional stage. But have we provided for this transition? Do current policies and direction foster the environment needed to accomplish the proper planning, programming and budgeting activities which will lead us into this phase of DOD space activities.

This study will not attempt to answer these broad questions but rather to focus on them as they relate to the USAF National Ranges and the part these resources will play as the ground segment of space systems in the 1980's. Space systems such as the Joint DOD/NASA Space Transportation System (STS or Space Shuttle) and Satellite Control Satellite (SCS) or tracking and Data Relay Satellite (TDRS) in NASA terminology, will then be available to further realize this transition to the new era in DOD space activities. These new programs are incorporated into DOD plans and receive their funding within the framework of the Planning, Programming, and Budgeting System (PPBS) of the DOD. The PPBS is an integrated system for the establishment, maintenance and revision of the Five Year Defense Plan (FYDP) and the DOD budget (17:4). The FYDP summarizes the Secretary of Defense approved plans and programs for DOD (17:3). The PPBS provides the procedural guidance for submission and approval of new programs and the associated budgets, as well as, making changes to the approved resources and budgets. Flowing from this procedural guidance, however, is specific guidance for each of the ten major categorizations of DOD forces (e.g. Strategic Forces, General Purpose Forces, etc.) in the form of other Directives and Service regulations. The policies and direction guiding the planning, programming and budgeting

system (PPBS) processes for major spacecraft acquisitions such as the Shuttle and SCS are clearly embodied in DODD 5000.1, "Acquisition of Major Defense Systems," and each service's corresponding directives. But what about the indispensable ground segment of many of these systems, specifically, the Eastern and Western Test Ranges (ETR/WTR) and the Air Force Satellite Control Facility (AFCSF)? There PPBS Guidance is contained in Directives and Regulations relating to Test and Evaluation activities. Will current policies and direction for these Test and Evaluation (T&E) resources stimulate the necessary PPBS actions for the major acquisitions to upgrade these resources for their effective and efficient use in this time period? That question is the subject of this ISP investigation.

Specific Goals

The specific goals of this investigation are to:

- a. gain an understanding of the directives and regulations which govern the PPBS activities for USAF National Ranges,
- b. identify future USAF National Range change requirements necessary to support and exploit the capabilities of the Space Shuttle and Satellite Control Satellite for the operation of space forces in the 1980's and beyond, and
- c. determine how effectively current policies and procedures governing the PPBS for USAF National Ranges will lay the foundation for the thorough and orderly development of these resources to provide the ground support capabilities needed in the Shuttle and SCS era.

SCOPE

As stated previously, this investigation will be confined to an analysis of the PPBS for USAF National Ranges. Those facilities so designated by the Secretary of Defense are:

Eastern Test Range (ETR)

Space and Missile Test Center/Western Test Range SAMTEC/WTR

Satellite Control Facility (SCF)

Arnold Engineering Development Center (AEDC) (2: Encl 1)

However, since this report is primarily concerned with the ground support segment for space operations, for obvious reasons only the ETR, WTR and SCF will be specifically addressed in the investigation.

This investigation will also be confined to an analysis of the formal direction in these areas provided by the DOD directives and Hqs. USAF and Air Force Systems Command (AFSC) regulations. It is recognized that within and between these organizations there may exist less formal guidelines, procedures and agreements for carrying out the planning, program and budgeting for these Ranges. The task at hand, however, is to determine if the formal documentation reflects the best approach to the PPBS process for providing space operations support.

Assumptions

Two assumptions are inherent in this study effort. The first is that the ETR, WTR and SCF will continue as the primary ground support elements for DOD space programs. Although in recent years some space programs have utilized dedicated ground support facilities, nearly all rely on the SCF in some form or another for certain types of support. And of course, all are

launched from either the WTR or ETR. The second assumption is that the 1980's will see a Space Shuttle and a Satellite Control Satellite which relays data from product satellites out of line of sight of the CONUS back to a station in the CONUS. While the former appears well on its way to becoming a reality the latter is somewhat less certain. Rationale for pursuing the employment of Satellite Control Satellites to replace SCF Remote Tracking Stations (RTS) around the world will be offered in the body of the report.

Organization of Report

This report is divided into five sections. Section I addresses the purpose, specific goals, scope, and assumptions of this ISP. Section II reviews the organizations responsible for USAF National Range PPBS activities and the directives and regulations setting forth their responsibilities. Section III describes the new requirements for USAF National Ranges to support DOD space activities in the Shuttle/SCS era. Section IV is a discussion of the effectiveness of current PPBS guidance for the USAF National Ranges in managing the development and acquisition of the capabilities for the Ranges to exploit the potential of the Shuttle and SCS systems. Section V provides conclusions regarding their effectiveness and recommendations for improvement to meet the challenge of planning for expanding DOD activities in space.

SECTION II

PPBS FOR USAF NATIONAL RANGES

The planning, programming and budgeting activities for the USAF National Ranges flow between OSD, Hq USAF, Hq AFSC and each of the Range Organizations. These activities are primarily conducted within the Test and Evaluation (T&E) offices of each of these organizations. A discussion of the key organizational elements at each of these levels and the documentation governing their PPBS actions follows.

OSD

At the OSD level the key organization responsible for T&E matters is the Deputy Director, Test and Evaluation (3:28). Its organizational location is shown in Figure II - 1.

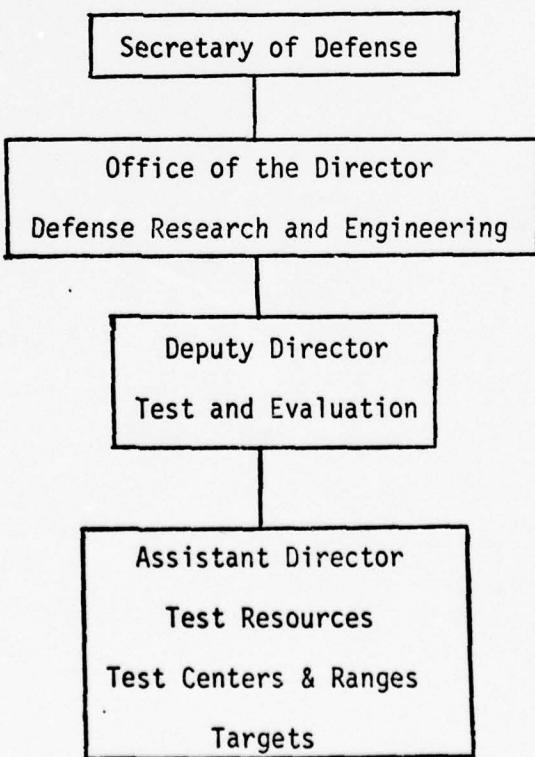


Figure II - 1

The charter for DD(T&E) includes "....administering for OSD its responsibilities for the national and service ranges" (3:31). DODD 5000.3, "Test and Evaluation" and DODD 3200.11, "Use Management and Operation of Department of Defense Major Ranges and Test Facilities" are the two key directives which establish the DD(T&E) responsibilities regarding USAF National Ranges. Relative to this, DODD 5000.3 simply states that DD(T&E) has "across-the-board responsibility for OSD test and evaluation matters" (4:7) and will fulfill "OSD responsibilities for the National and major service test facilities" (4:8). In DODD 3200.11 the stated mission of the Major Ranges is to:

"Provide a broad range and test support base to all DOD components responsible for development, test, evaluation and operation, as applicable, of material and weapon systems, and to other Federal Government Agencies having need for that support." (2:2)

In both of these documents, the USAF National Ranges are depicted as relatively static resources for development and operational testing of material and weapon systems. This is clearly evident in the DODD 3200.11 definition of a Range:

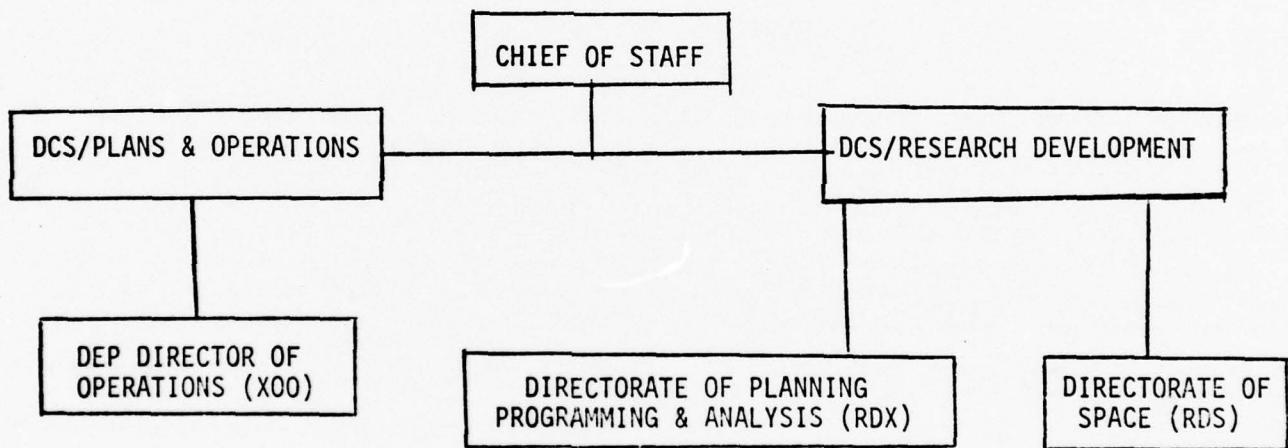
"A complex of instrumentation deployed over a designated geographic area and configured for the support of operational and developmental test and evaluation of weapon and space systems, subsystems and components." (2:Encl 3)

Thus, the view taken is that these National Ranges (including the WTR, ETR and SCF) are research, development, test and evaluation (RDT&E) assets whose major function is to support the development and operational testing of major weapon systems acquisitions. This is the thrust of the overall policy

direction and planning guidance from OSD on which the services as the management agencies for the ranges are to base their actions. USAF implementation of the directives is described next.

HQ USAF

Responsibility for the USAF National Range activities becomes less centralized at the Air Staff level. Three offices are involved in the PPBS actions for the Ranges as shown in Figure II-2.

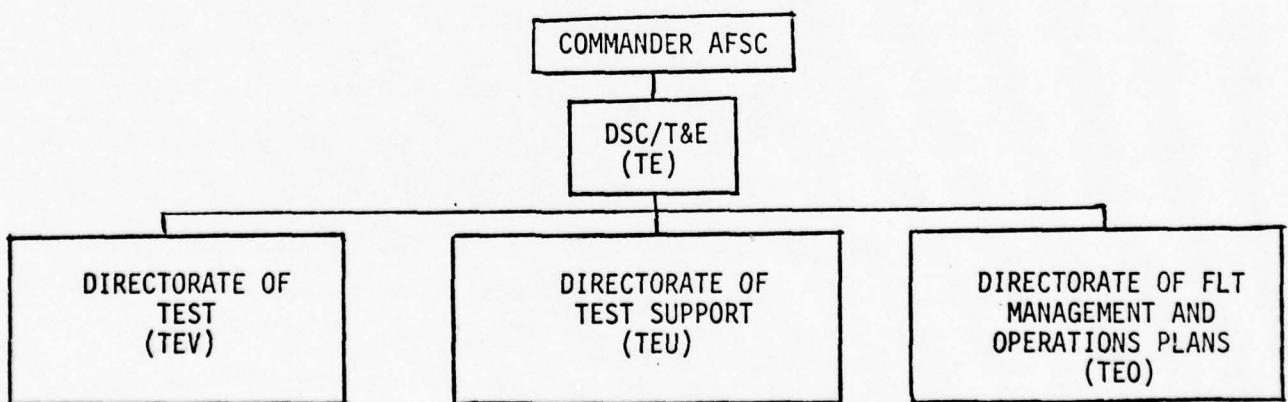


RDX has overall responsibility for T&E activities. In this capacity responsibility for ETR and SAMTEC PPBS actions comes under their purview. However, in 1972, responsibility for the SCF was transferred to RDS in recognition of the SCF's diminished role in T&E activities and the fact that it represents the ground segment of many space programs. The SCF, nevertheless, continues to be categorized in USAF PPBS documentation as a National Range and T&E resource. XOO has responsibility for the weapon system side of OT&E activities and that aspect of T&E policies.

Specific HQ USAF direction in response to DODD 5000.3 and 3200.11 for the Ranges is primarily contained in AFR 80-14 "Test and Evaluation." RDX is the office of primary responsibility for this regulation. As with the DOD Directives relating to T&E this document also tends to view the USAF National Ranges as relatively static entities, existing primarily for development and operational testing of major weapon systems. They are briefly mentioned in the "Policies" section of the regulation (5:2).

HQ AFSC

Until a short time ago, test resources within AFSC were the responsibility of DCS/Operations and the focal point for T&E actions was DCS/Systems. However, a recent reorganization at Hq AFSC has combined these functions under a single Deputy Chief of Staff (DCS/Test and Evaluation)(6:1). Organization of this office is shown in Figure II-3.



TEV has responsibility for T&E policies and procedures and the weapon systems interfaces. TEU acts as the focal point for the Ranges and Centers under AFSC's cognizance. The third Directorate is responsible for flight

operation management and operational exercises and plans. This reorganization appears to fortify the general view that the existence of the USAF National Ranges is primarily for the purposes of supporting DT&E and OT&E activities. Two AFSC regulations relate to the National Ranges. The first is a Supplement to AFR 80-14. Like the regulation it supplements, it refers to the Ranges as facilities to be utilized for development and operational test and evaluation. This regulation also assigns responsibility to the weapon system program offices for budgeting and funding the direct costs of test and evaluation with these facilities (7:6). Thus, modifications to these facilities are to be justified on the basis of the T&E requirements of a specific using program. This concept is expanded in a second regulation, AFSCR 172-8, which established the responsibilities, and procedures for budgeting and funding for T&E support costs at these facilities under the Uniform Funding Policy (8:1). This Policy requires that direct costs associated with a particular test program be reimbursed by the Program Office to the facility. Components of these costs include special instrumentation, operation of the test resources, travel and per diem, etc. Users are required to budget for these costs and provide the funds to the test facility (9:10-3). This Policy applies to all of the USAF National Ranges except the SCF. It is clear from this policy that the PPBS activities for the Ranges are the result of requirements generated by a particular Program and must be specifically identifiable to that Program.

In summary, it can be concluded that basic guidance for USAF National Range PPBS actions are governed by the T&E activities which stem from DODD 5000.3 and 3200.11. AFR 80-14 implements this DOD direction, AFSC

Supplement 1 implements the Air Force direction in AFSC and AFSC 172-8 implements the Uniform Funding Policy. The next step is to examine the future requirements for these National Ranges as DOD expands space activities in the Shuttle/SCS era and then in the following section to determine if this documentation points the way toward meeting these needs.

SECTION III

NATIONAL RANGE REQUIREMENTS FOR THE SHUTTLE/SCS ERA

The previous Section reviewed current directives governing the management of the USAF National Ranges. The picture painted was of relatively static facilities with changes made on the basis of a particular program's T&E needs. On the horizon, however, is the prospect of a significant readjustment of this picture and the WTR, ETR and SCF will play an important part. As we approach the 1980's, we move closer to the day when a new phase of DOD space activities will be possible where operational applications can be fully exploited. Two space systems which can usher in this new era are the Space Shuttle and the Satellite Control Satellite (SCS). There are, of course, a number of other new space programs on the horizon, such as the Navstar Global Positioning System (GPS) and new communications satellites for the AF and Navy. But these other space systems are essentially "product" satellites. That is, their purpose and output is a product for DOD and other users, e.g., positioning/navigation, communications/data, surveillance, etc.). The Shuttle and SCS are however, "service" systems whose function is to support the "product" satellites. One inserts them into their orbits and the other provides the means for telemetry, tracking and commanding (TT&C) support. It is true that some space functions may be conducted on a Shuttle Orbiter, but it is still in a sense the service vehicle for the functional apparatus. One can also argue that communications satellites are performing a service, but their categorization as product satellites emphasizes their role in direct support of DOD terrestrial and airborne forces and agencies. Today the "services" that

these two new systems offer are provided by expendable boosters and remote ground stations located around the world. With the reusable Shuttle it is expected that the costs to place payloads in orbit will be significantly reduced, making space systems a more attractive alternative for meeting DOD needs (as well as the needs of the Nation). The SCS offers the potential for providing nearly 24 hour TT&C support to a satellite from the CONUS and the elimination of manpower intensive TT&C ground station networks, especially those on foreign soil. Following is a more detailed discussion of each of these systems and the effect each will have on the configuration and missions of the Ranges (ETR, WTR and the SCF).

Space Transportation System (Shuttle)

The initial Space Transportation System consists of the Space Shuttle Vehicle (SSV), the Interim Upper Stage (IUS), and the supporting facilities on the ground (10:1). Eventually, the IUS will be replaced by a reusable Tug, the IUS or TUG to be used to place satellites in higher orbits than the SSV is capable of achieving. A typical mission profile is shown in Figure III-1. NASA is developing the Orbiter and all of their required ground support including launch/landing and checkout facilities at ETR. The DoD STS program is using a three phase developmental approach. In Phase IA (now to 1980/82) NASA has responsibility for planning and control of all but the DOD payload aspects of the program. All launches will be from ETR under NASA control. Phase IB begins with the Initial Operational Capability (IOC) at the WTR by 1983 to 1985. Launches from WTR during this phase will be DOD controlled. Phase II occurs in the latter half of the 1980's when DOD assumes SSV flight planning and operations responsibility

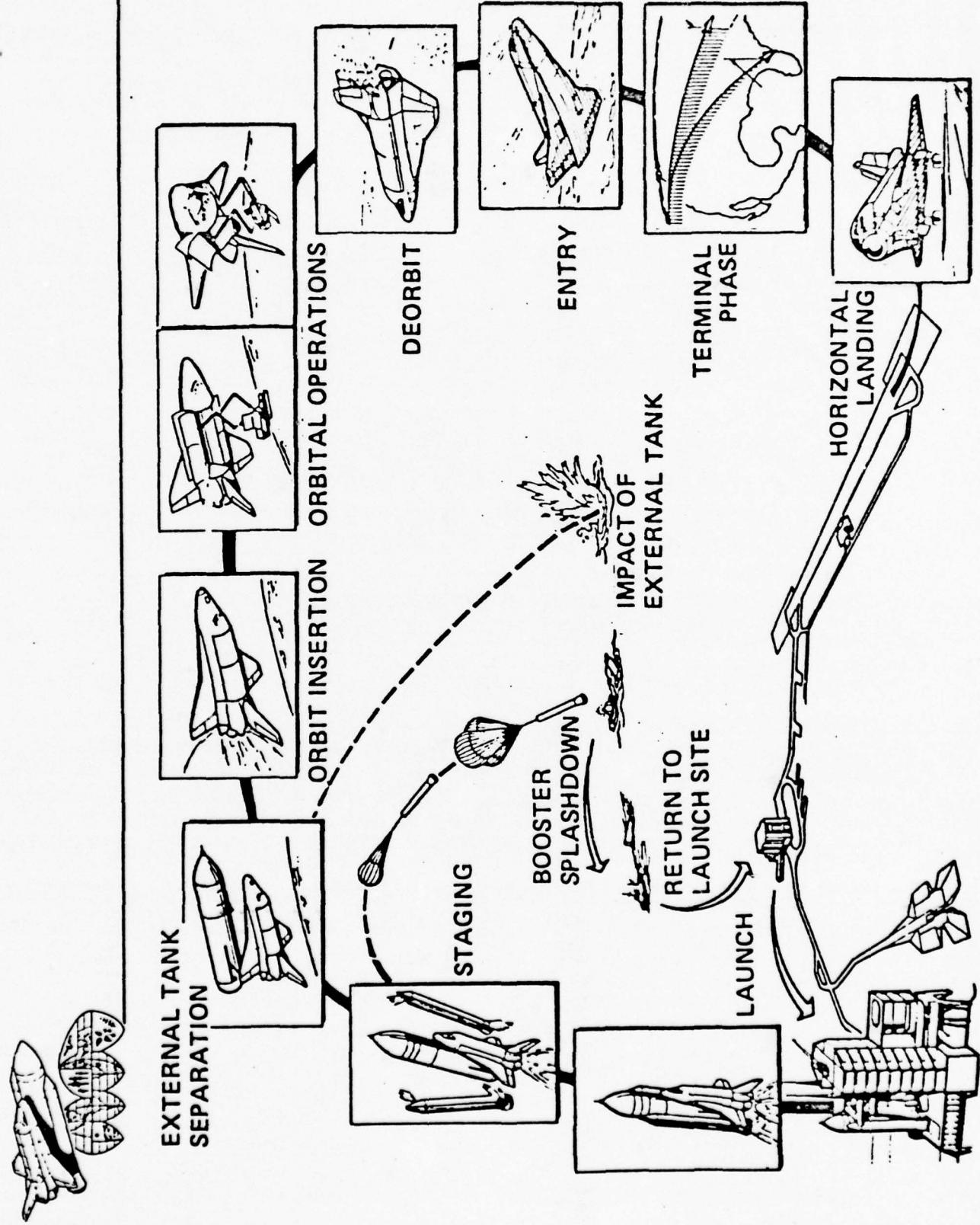


Figure III-1 Typical Space Shuttle Mission Profile

for their missions. (10:1).

ETR

Major modifications at ETR involve the launch/landing facilities including two launch pads and the assembly and check-out facilities for both the SSV and the IUS/Payload. Nearly all of these facilities have been planned programmed and budgeted for by NASA. Exact figures have not been obtained, but it is estimated that facilities costs will be in excess of \$115M (11:66). The DOD STS Program Office, Air Staff Committees and USAF/RDS interface with NASA to input DOD requirements. In addition to these facilities, interfaces with the STS communications and tracking (C&T) network will be required at ETR. In Phase IA, this will be a mixture of DOD and NASA equipments. DoD will have responsibility for prelaunch, ascent and on-orbit check-out and monitoring of DOD payloads. At ETR this will require an upgrading of the SCF's Remote Vehicle Checkout Facility (RVCF) and a higher data rate communications capability from ETR to the Satellite Test Center (STC) at Sunnyvale, California. Required modifications and associated costs which DOD will fund are yet to be defined (10:7). Nevertheless, since NASA is funding and accomplishing most of the ETR Shuttle Program modifications, the DOD PPBS activities are not expected to be significant. The real impact to DOD planning activities for ETR occurs some time after Shuttle becomes operational when launch facilities for expendable boosters will no longer be necessary. Furthermore, the requirements for ETR downrange facilities and Advanced Range Instrumentation Aircraft (ARIA) may be significantly reduced or eliminated. These factors could have considerable effect on future PPBS actions for ETR & WTR.

WTR

Phase IB DOD Shuttle activities occur a few years after ETR activities. DOD has assumed responsibility for the planning, programming and budgeting of all facilities modifications at WTR. The baseline operations plan has not been completed so facilities requirements have not been completely defined (12:87). They will include, however, launch/landing facilities with two launch pads; transport, assembly and checkout facilities for the SSV and payloads; a launch control complex; and crew training/housing facilities. No detailed cost figures are available, but previous estimates placed the figure at roughly \$700M (11:22). The effort is expected to take approximately six years to complete (12:89). This major PPBS activity is the responsibility of HQ USAF, but it is not being accomplished by the T&E organizations through the normal WTR funding channels. The funds for the WTR work are included in the DOD STS Program funds administered by USAF/RDS and the DOD Shuttle Program Office. The T&E Offices in DOD, USAF and AFSC are not acting as office of primary responsibility (OPR) for these major range acquisitions. This is another indication that as we move ahead in space activities these National Range resources are being recognized more and more as inseparable parts of space systems. Further impact of Shuttle on WTR is also expected to be felt after IOC, when like ETR, the need for other launch pads and range support facilities will be diminished. Thus, it is quite apparent that major PPBS actions for WTR from now through the 1980's will occur.

SCF

During the Phase IA period of DOD Shuttle activities NASA will retain responsibility for SSV control throughout all phases of the mission. DOD

will be responsible for control of the payload while it is inside the SSV. Data from the payload can be received in two ways at the SCF's Satellite Test Center in Sunnyvale, California. The first is via the NASA communications system from Johnson Spacecraft Center (JSC), Houston. SSV data received by NASA contains payload data as well. SSV data are returned to JSC via the NASA Ground Space Tracking and Data Network (GSTDN) and the Tracking and Data Relay Satellite (TDRS) during ascent. On orbit the SSV is supported by JSC via the TDRS System. The signals from the SSV must be forwarded to the STC so that payload telemetry can be extracted while it is still within the SSV. The configuration of the communications link between JSC and the STC has not been completely defined at this time (10:7). A second means for receiving telemetry from the payload inside the SSV is from a separate antenna on the SSV transmitting directly to an SCF RTS which then sends it to the STC. After deployment of the payload an RTS supports the payload directly.

If a Satellite Control Satellite or capability at the STC to receive TDRS relayed data were available, the need for the intermediate RTS reception/relay and the limited contact time associated with this means of support would be eliminated. This becomes even more important when DOD assumes full control of Shuttle activities in the later phases. (These two points will be discussed further in the next Section on the SCS). After deployment of the payload the SCF provides support when required and an RTS is visible to the payload.

One of the most significant changes to SCF support functions that will occur with Shuttle operations is the elimination of all of the very critical

and intensive TT&C functions performed for space systems during the ascent and early orbit phases of their employment. Today with a limited number of RTS's around the world many space programs must make costly compromises to spacecraft designs to delay important events during ascent and early orbit phases until ground TT&C capability exists through one of the RTS's. Since the Shuttle will provide the capability to checkout spacecraft after ascent and after release from the SSV it will no longer be necessary to rely on the SCF to command or monitor critical sequences on the spacecraft. This could significantly reduce the amount of hardware and software the SCF requires to provide this ascent and early orbit support. It, in turn, permits much more flexibility to spacecraft designers and mission planners in reducing costs and minimizing risks.

It is obvious from the foregoing, that the Shuttle Program could significantly affect the plans for the SCF in the 1980's. It may be that sizable savings in cost and manpower could be achieved if planners take full advantage of the flexibility offered by the Shuttle. The next section will discuss the SCS concept and the additional flexibility and potential savings offered by this advancement in spacecraft support capabilities.

Satellite Control Satellite

Space technology has advanced to the point today where spacecraft-to-spacecraft communications and precision locating schemes are within the state-of-the-art. These advances make possible a new scheme for providing telemetry, tracking and commanding (TT&C) support and the retrieval of payload data. DOD calls the concept the Satellite Control Satellite (SCS)

and NASA calls it the Tracking and Data Relay Satellite System (TDRSS).

Today the SCF accomplishes this task with nine Remote Tracking Stations (RTS) at six locations around the world (13:1-1). Operation of these RTS's is controlled by the Satellite Test Center (STC) at Sunnyvale, California. When a Satellite is visible to one of these RTS's, TT&C tasks are conducted and telemetry and/or payload data are received by the RTS and relayed via land and underwater cable communications links or communication satellite links to the STC. These data are then further distributed as needed to users from the STC. Some spacecraft systems utilize the SCF for TT&C functions primarily related to status and health, while receiving payload data directly at their own dedicated ground stations.

The SCS offers the potential for a significant improvement in the control of space systems. The concept employs a constellation of satellites capable of retrieving payload and telemetry data, providing tracking data on the product satellites, and commanding or sending command computer loads to the spacecraft. This can be accomplished from any point(s) desired in the CONUS. With just a two satellite configuration even the lowest altitude product satellites and the Shuttle would be accessible for support for approximately 85 percent of each orbit. The coverage excluded will be a function of the spacecraft altitude and inclination. This is illustrated in Figure III-2, which is a projected deployment of the NASA TDRS System, the same concept as the DOD SCS (14:2-4). Any satellite, properly configured to communicate with an SCS, could be supported from a CONUS ground station at any time except when it is in the zone of exclusion. Following is a discussion of the improvements to the Ranges which would be possible

TDRS WEST
LONG. 171° WEST

TDRS EAST
LONG. 41° WEST

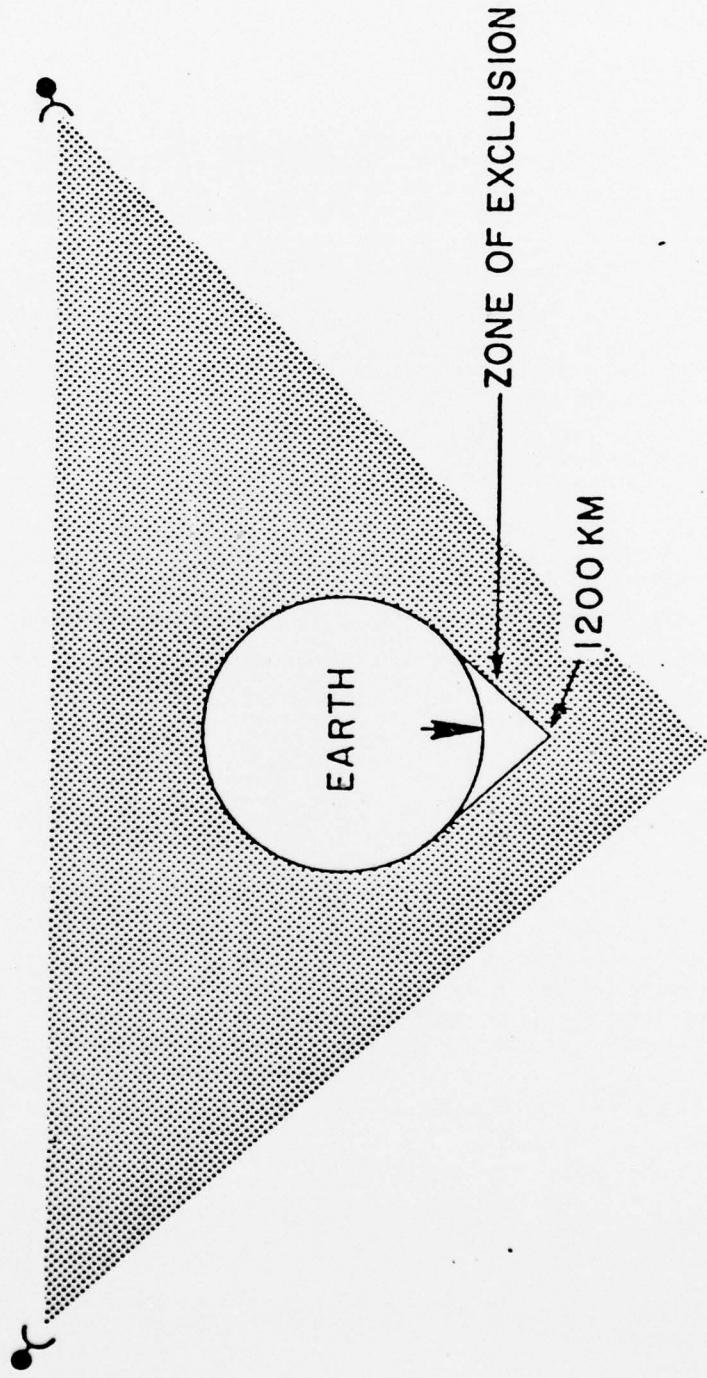


Figure III-2 Tracking and Data Relay Satellite System

with the employment of an SCS system.

ETR/WTR.

An SCS system along with the Shuttle would appear to permit sizable cutbacks in the downrange tracking and telemetry networks at each Range. It could also lead to the eventual elimination of ARIA systems. Manpower and cost savings could be sizable. However, one factor which could preclude the total elimination of downrange network facilities and ARIA is the design of the spacecraft-to-spacecraft link of the SCS. If, for performance and/or cost reasons, it is of a type and frequency which will not penetrate the atmosphere, then some means of providing support to ballistic or other tests when within the atmosphere would be necessary. This might require the continuation of some facilities such as the terminal instrumentation in the Pacific. The Shuttle should provide this capability for space launches, however. Whatever the final configuration, it is clear that a Shuttle System coupled with an SCS System will have a sizable impact on the configuration of the downrange facilities of the ETR and SAMTEC/WTR.

SCF

The most significant impact with the employment of an SCS system would occur to the SCF. Radical changes to the current means of providing satellite support would be possible. In addition to the operational improvements that an SCS offers, the economic, political and security benefits accruing as a result of the elimination of RTS's are quite substantial.

With average annual Operations and Maintenance (O&M) costs in excess of \$5M per RTS, a significant cost savings is possible. The savings may be

sufficient to amortize the cost of an SCS system over its lifetime. Furthermore, with the current trend to reduce manpower, the elimination of the manpower intensive RTS becomes quite desirable.

Two RTS's are located on foreign soil. Thus, the successful operation of vital DOD space systems is dependent upon continued acceptance of their presence by host country governments. Eliminating the RTS's eliminates this dependence and thus puts back into the hands of the U.S. the total control and security of the ground support segment for our space forces.

Employment of an SCS system would also affect the nature and functions of the STC, the hub of operations support activities for DOD space systems. With the elimination of RTS's and the ability of users of space systems to communicate and retrieve data directly from their spacecraft, much, consolidation of functions at the STC could take place. The need for a single STC is also no longer apparent. Thus, future plans for ground support activities could consider a wide variety of schemes from totally decentralized ground support facilities for each space system to a centralized system with the STC or its successor as a central CONUS receiving and transmitting point through the SCS. The SCS concept permits a decision on the extent of operational decentralization to be based on cost, survivability and mission effectiveness, rather than on some basic limitation of the control system (15:62). It would appear, however, that as a minimum the role of the SCF would be to support the "service" space systems, the Shuttle/IUS(TUG) system and the SCS, and any other "service" satellites from a central location (or redundant locations for survivability). Support of "product" satellites could be accomplished from user locations through an SCS. Th

SCF could also serve as a backup to these facilities in this mode if necessary.

Based on the above it appears quite probable that a military SCS system will be implemented in the 1980s. This conclusion was also reached by space planners conducting studies of future military space activities at AFSC's Space and Missile Systems Organization (SAMSO) (15:59).

Summary

To summarize this Section of the ISP it is apparent that major changes in the configuration, roles and missions of the USAF National Ranges (ETR, WTR & SCF) can be expected as a result of the employment of the Space Shuttle and SCS Systems. A recent study of future roles and missions of the AF in space (Reference 16) posed two significant questions; (1) how can we best take advantage of the Shuttle's unique capabilities (16:xvi) and (2) how do we satisfy the three demands that confront the future planner of ground station capabilities - realization of the savings associated with consolidation of similar functions, survivability, and reduced dependence on overseas facilities (16:5-8). It is clear that the changes to the Ranges discussed in this Section will play a significant part in answering these questions. But a third question was posed by the USAF study team; "How should we manage the development, acquisition and operation of military space systems to assure the most efficient and effective use of these systems?" (16:xvi). The next section will be involved with that question as it relates to the USAF National Ranges and how effectively the current directives and regulations governing them will guide the transition to this new era in space activities.

SECTION IV

EFFECTIVENESS OF CURRENT PPBS GUIDANCE

The previous Section has described a number of major changes to the USAF National Ranges that will occur as we move into a new era of space activities in the 1980's. A number of these actions are of the same magnitude and complexity as many of the major weapon systems acquisition programs on-going today. Yet the organizations in DOD, USAF & AFSC who normally staff the PPBS actions for these Ranges are still operating under directives and regulations designed for relatively static conditions.

Yearly budgets are geared to sustaining effort with some small amount for modernization, etc. Significant changes or additions to the Range resources must be sponsored and funded by the weapon system program office requiring the changes for its T&E activities at the Range. In this environment it is difficult to envision these T&E organizations conducting the planning activities for the range modifications described in Section III in an effort to fully exploit the potential of the shuttle and SCS systems. This is not meant to be an indictment of the T&E organizations in DOD, USAF and AFSC. On the contrary, their job has been made more difficult by this conflict of roles that is growing with ETR, WTR and the SCF. Their job is to insure that thorough and cost/effective T&E tasks are conducted for the Programs requiring them. The increasing use of these Ranges for operational support of space systems makes the job of scheduling and conducting T&E activities that much more difficult. Testing is nearly always of lower priority than operational support.

At the Air Staff level, the transfer of responsibility for the SCF

from RDX to RDS and the use of Shuttle Program funding, managed by RDS, for Range modifications are significant steps in recognizing the changing roles of the Ranges throughout the chain of command from AFSC to DOD. However, as pointed out in Section II, at the DOD and AFSC levels PPBS activities for the USAF National Ranges remain the responsibility of the T&E organizations. Range involvement in space operations continues to be viewed as part of RDT&E functions. This diversity of responsibility and orientation of the chain of command would not appear to be the best environment for managing the PPBS actions for the Ranges as we enter this new era in space activities. It is difficult to see how a concerted effort to insure that the best configuration of spacecraft and ground support segments for this new era in DOD space operations would be possible when these organizations are viewing their responsibilities from different perspectives. Consideration of some modification to current management practices would appear to be in order.

SECTION V

CONCLUSIONS/RECOMMENDATIONS

The evidence strongly indicates that the roles and missions of the USAF National Ranges have been changing and will continue to change as we move into the Shuttle/SCS era of space activities. The evidence also suggests that the current directives and practices governing the PPBS actions for these Ranges might not be the most effective for planning future space activities and exploiting the benefits that are offered with the Space Shuttle and an SCS.

The New Horizons II Study identified two distinct disadvantages to continuing current practices in managing our space activities:

"First, as space forces continue to grow, AFSC involvement will also continue to grow and could further divert AFSC resources, including its invaluable R&D management expertise, from its primary mission: developing a rapidly expanding technology base as an essential element in maintaining US military power. Second, the Air Force might neglect to adequately develop the operational policies, formal procedures, functional offices, etc., that are needed to ultimately integrate all operational space functions into the operational Air Force." (16:5-12)

The first step to solve these problems is to clearly differentiate between the roles and missions of the USAF National Ranges as the ground support segment for DOD space forces and as T&E resources. The delegation of management responsibility to USAF/RDS for the SCF (and the Shuttle related acquisitions for ETR and WTR) is a significant step in the direction of recognizing these new roles for the Ranges. Unfortunately, RDS has responsibility for all USAF space activities with an 18 man office.

This relatively small staff cannot be expected to shoulder the complete burden of defining the roles and missions for the Ranges and carrying out the PPBS actions to provide the most cost/effective configurations for accomplishing these missions. As suggested by the New Horizons II Study it may be appropriate to consider a single, perhaps new, command for total management of DOD space activities (16:5-12). As a minimum, however, offices complimentary to RDS should exist at the OSD and AFSC levels so that all levels will view the PPBS actions for space forces from both the spacecraft and ground support segment standpoint.

Furthermore, if we are to fully exploit the potential of these ground elements of our space systems the ranges must be encouraged to propose new capabilities and configurations that are not necessarily tied to the requirements of a particular satellite program but offer advantages on a broader scale such as are described in Section III.

The following actions are proposed to better orient the PPBS funding activities for the Ranges around their expanding and now predominant role as the ground segment of space forces:

- (1) The T&E directives and regulations described in Section II should be revised to reflect recognition of the operational roles of the ETR, WTR and SCF. This is important not only to insure recognition of these roles in PPBS actions, but also to highlight the existence of these dual roles (operational support and T&E support) so that programs will be more aware of the limitations placed on T&E activities because of higher priority operational support.

(2) At the OSD level responsibility for the PPBS actions of the Ranges as they relate to the operational support role should be separated from DD (T&E) and included in the Space Systems activities of DDR&E.

(3) At the Air Staff level, in addition to the SCF, RDS should have responsibility for ETR and WTR PPBS activities relating to operational support. This would permit a more comprehensive planning effort for all space forces including the ground elements. The implications of future activities in space such as the employment of an SCS capability could be viewed from an overall space forces viewpoint. Furthermore, HQS, USAF should be actively pursuing the development of an SCS capability to provide the operational flexibility needed to fully exploit the potential of space as a means of satisfying future military requirements. The SCS has the added cost benefit of the elimination of manpower intensive RTS's and reliance on overseas bases to support space systems.

(4) At HQS AFSC, the same shift of organizational responsibility for ETR, WTR and the SCF in terms of their operational roles should occur from DCS/T&E to DCS/Systems.

(5) AFSC should review the Charters for these Ranges to insure that they adequately reflect the more dominant roles in operational support of space forces.

(6) The Ranges should; (a) be encouraged to recommend system improvements on a broad scale not necessarily only responding to a particular satellite program's requirements, (b) expand the scope of planning activities, (c) consider the establishment of a program office within the SCF for the SCS. Coordination of all user requirements for the SCS, including ground segment users (e.g., ETR and WTR) as well as spacecraft users, could be accomplished by the SCF in the same manner as is accomplished today for the SCF ground network.

Current plans call for DOD Shuttle missions starting in 1980. The employment of a satellite control satellite some time in the 80's appears quite probable. Management of space activities for this new era in DOD space operations should assure the most efficient and effective use of the capabilities offered by these systems and this must include proper consideration of the ground segment of these space forces.

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